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MOTOROLA

MC1350

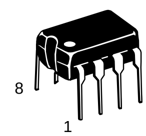
Monolithic IF Amplifier

IF AMPLIFIER

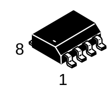
SEMICONDUCTOR TECHNICAL DATA

The MC1350 is an integrated circuit featuring wide range AGC for use as an IF amplifier in radio and TV over an operating temperature range of 0° to +75°C.

- Power Gain: 50 dB Typ at 45 MHZ
  50 dB Typ at 58 MHZ
- AGC Range: 60 dB Min, DC to 45 MHz
- Nearly Constant Input & Output Admittance over the Entire AGC Range
- Y_{21} Constant (–3.0 dB) to 90 MHz
- Low Reverse Transfer Admittance: < < 1.0 μmho Typ
- 12 V Operation, Single–Polarity Power Supply



P SUFFIX
PLASTIC PACKAGE
CASE 626



D SUFFIX
PLASTIC PACKAGE
CASE 751
(SO–8)

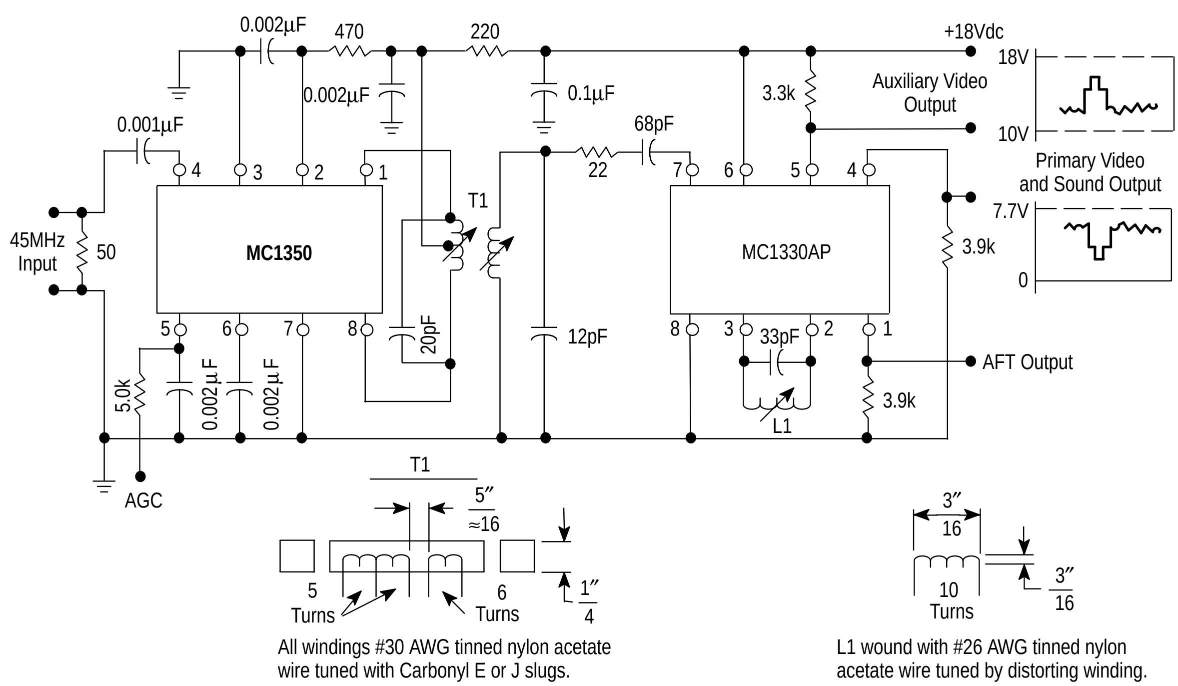
MAXIMUM RATINGS (T_A = +25°C, unless otherwise noted.)

Rating	Symbol	Value	Unit
Power Supply Voltage	V^+	+18	Vdc
Output Supply Voltage	V_1, V_8	+18	Vdc
AGC Supply Voltage	V_{AGC}	V^+	Vdc
Differential Input Voltage	V_{in}	5.0	Vdc
Power Dissipation (Package Limitation) Plastic Package Derate above 25°C	P_D	 625 5.0	 mW mW/°C
Operating Temperature Range	T_A	0 to +75	°C

ORDERING INFORMATION

Device	Operating Temperature Range	Package
MC1350P	T_A = 0° to +75°C	Plastic DIP
MC1350D		SO–8

Figure 1. Typical MC1350 Video IF Amplifier and MC1330 Low–Level Video Detector Circuit



ELECTRICAL CHARACTERISTICS (V^+ = +12 Vdc, T_A = +25°C, unless otherwise noted.)

Characteristics	Symbol	Min	Typ	Max	Unit
AGC Range, 45 MHz (5.0 V to 7.0 V) (Figure 1)		60	68	–	dB
Power Gain (Pin 5 grounded via a 5.1 kΩ resistor)	A_p				dB
f = 58 MHz, BW = 4.5 MHz See Figure 6(a)		–	48	–	
f = 45 MHz, BW = 4.5 MHz See Figure 6(a), (b)		46	50	–	
f = 10.7 MHz, BW = 350 kHz See Figure 7		–	58	–	
f = 455 kHz, BW = 20 kHz		–	62	–	
Maximum Differential Voltage Swing	V_O				V_{pp}
0 dB AGC		–	20	–	
–30 dB AGC		–	8.0	–	
Output Stage Current (Pins 1 and 8)	$I_1 + I_8$	–	5.6	–	mA
Total Supply Current (Pins 1, 2 and 8)	I_S	–	14	17	mAdc
Power Dissipation	P_D	–	168	204	mW

DESIGN PARAMETERS, Typical Values (V^+ = +12 Vdc, T_A = +25°C, unless otherwise noted.)

Parameter	Symbol	Frequency				Unit
		455 kHz	10.7 MHz	45 MHz	58 MHz	
Single–Ended Input Admittance	g_{11}	0.31	0.36	0.39	0.5	mmho
	b_{11}	0.022	0.50	2.30	2.75	
Input Admittance Variations with AGC	Δg_{11}	–	–	60	–	µmho
(0 dB to 60 dB)	Δb_{11}	–	–	0	–	
Differential Output Admittance	g_{22}	4.0	4.4	30	60	µmho
	b_{22}	3.0	110	390	510	
Output Admittance Variations with AGC	Δg_{22}	–	–	4.0	–	µmho
(0 dB to 60 dB)	Δb_{22}	–	–	90	–	
Reverse Transfer Admittance (Magnitude)	$\lvert y_{12}\rvert$	< < 1.0	< < 1.0	< < 1.0	< < 1.0	µmho
Forward Transfer Admittance						
Magnitude	$\lvert y_{21}\rvert$	160	160	200	180	mmho
Angle (0 dB AGC)	$< y_{21}$	–5.0	–20	–80	–105	Degrees
Angle (–30 dB AGC)	$< y_{21}$	–3.0	–18	–69	–90	Degrees
Single–Ended Input Capacitance	C_{in}	7.2	7.2	7.4	7.6	pF
Differential Output Capacitance	C_O	1.2	1.2	1.3	1.6	pF

Figure 2. Typical Gain Reduction

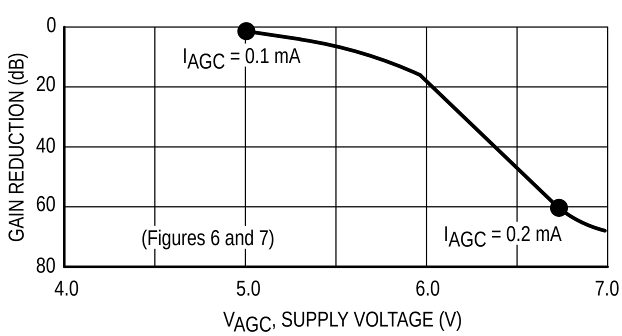
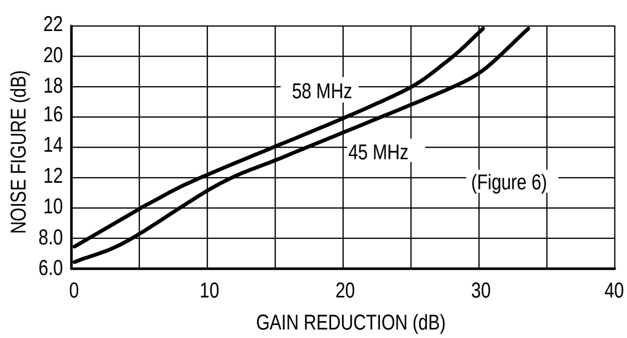


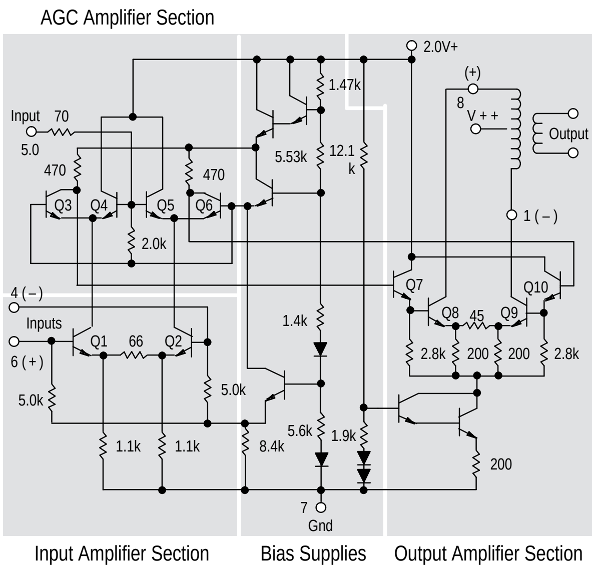
Figure 3. Noise Figure versus Gain Reduction



GENERAL OPERATING INFORMATION

The input amplifiers (Q1 and Q2) operate at constant emitter currents so that input impedance remains independent of AGC action. Input signals may be applied single–ended or differentially (for ac) with identical results. Terminals 4 and 6 may be driven from a transformer, but a dc path from either terminal to ground is not permitted.

Figure 4. Circuit Schematic



AGC action occurs as a result of an increasing voltage on the base of Q4 and Q5 causing these transistors to conduct more heavily thereby shunting signal current from the interstage amplifiers Q3 and Q6. The output amplifiers are supplied from an active current source to maintain constant quiescent bias thereby holding output admittance nearly constant. Collector voltage for the output amplifier must be supplied through a center–tapped tuning coil to Pins 1 and 8. The 12 V supply (V^+) at Pin 2 may be used for this purpose, but output admittance remains more nearly constant if a separate 15 V supply (V^{++}) is used, because the base voltage on the output amplifier varies with AGC bias.

Figure 5. Frequency Response Curve (45 MHz and 58 MHz)

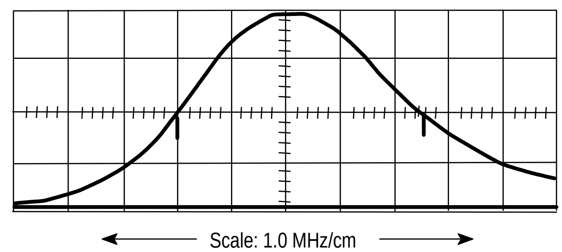
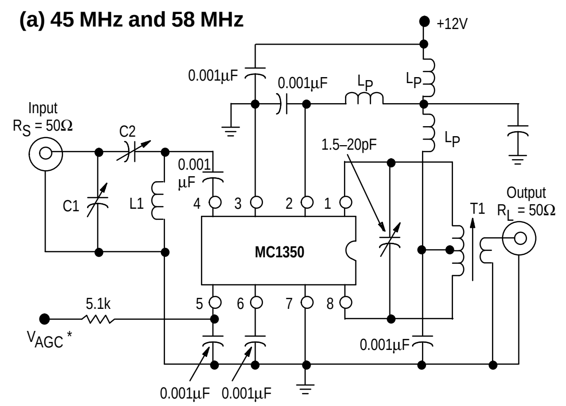


Figure 6. Power Gain, AGC and Noise Figure Test Circuits

(a) 45 MHz and 58 MHz

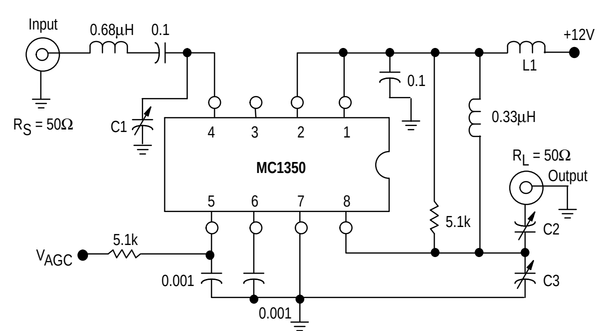


*Connect to ground for maximum power gain test.
All power supply chokes (Lp), are self–resonant at input frequency. $L_P \geq 20$ kΩ.
See Figure 5 for Frequency Response Curve.

L1 @ 45 MHz = 7 1/4 Turns on a 1/4″ coil form
@ 58 MHz = 6 Turns on a 1/4″ coil form

T1 Primary Winding = 18 Turns on a 1/4″ coil form, center–tapped, #25 AWG
Secondary Winding = 2 Turns centered over Primary Winding @ 45 MHz
= 1 Turn @ 58 MHz
Slug = Carbonyl E or J

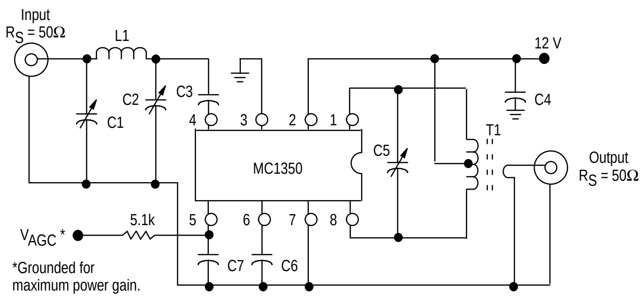
(b) Alternate 45 MHz



L1	Ferrite Core 14 Turns 28 S.W.G.
C1	5–25 pF
C2	5–25 pF
C3	5–25 pF

	45 MHz		58 MHz	
L1	0.4 µH	Q ≥ 100	0.3 µH	Q ≥ 100
T1	1.3 µH to 3.4 µH	Q ≥ 100 @ 2.0 µH	1.2 µH to 3.8 µH	Q ≥ 100 @ 2.0 µH
C1	50 pF to160 pF		8.0 pF to 60 pF	
C2	8.0 pF to 60 pF		3.0 pF to 35 pF	

Figure 7. Power Gain and AGC Test Circuit
(455 kHz and 10.7 MHz)



Component	Frequency 455 kHz	10.7 MHz
C1	–	80–450 pF
C2	–	5.0–80 pF
C3	0.05 µF	0.001 µF
C4	0.05 µF	0.05 µF
C5	0.001 µF	36 pF
C8	0.05 µF	0.05 µF
C7	0.05 µF	0.05 µF
L1	–	4.6 µF
T1	Note 1	Note 2

NOTES: 1. Primary: 120 µH (center–tapped)
Q_u = 140 at 455 kHz
Primary: Secondary turns ratio ≈ 13
2. Primary: 6.0 µH
Primary winding = 24 turns #36 AWG
(close–wound on 1/4″ dia. form)
Core = Carbonyl E or J
Secondary winding = 1–1/2 turns #36 AWG, 1/4″ dia.
(wound over center–tap)

Figure 8. Single–Ended Input Admittance

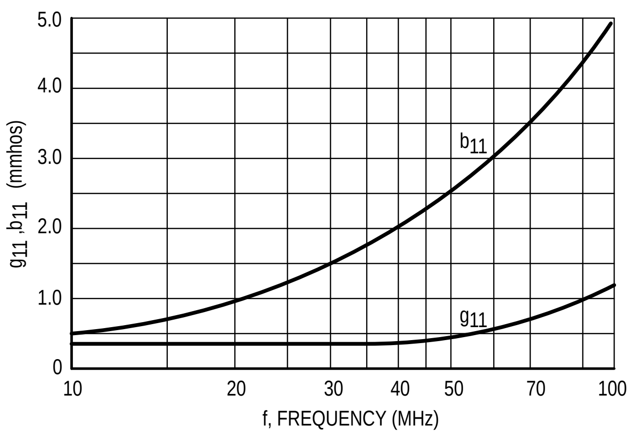


Figure 9. Forward Transfer Admittance

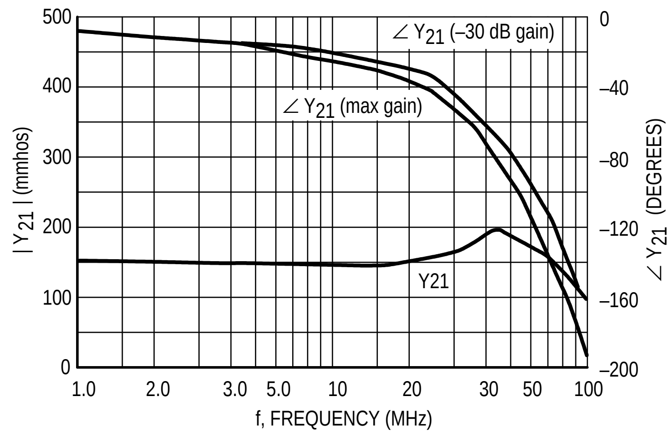


Figure 10. Differential Output Admittance

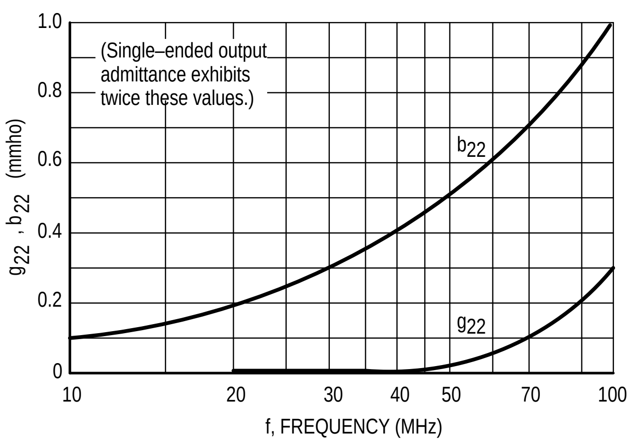
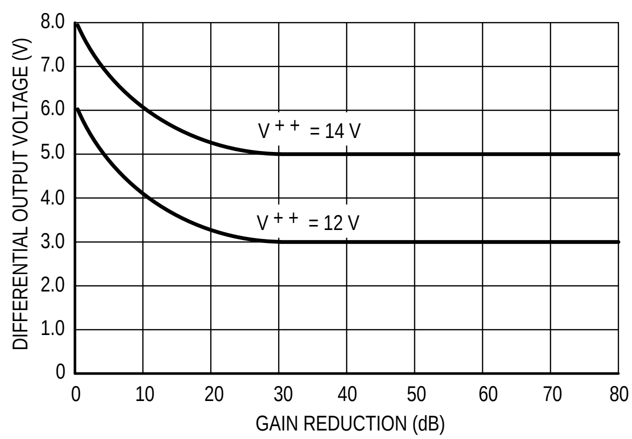
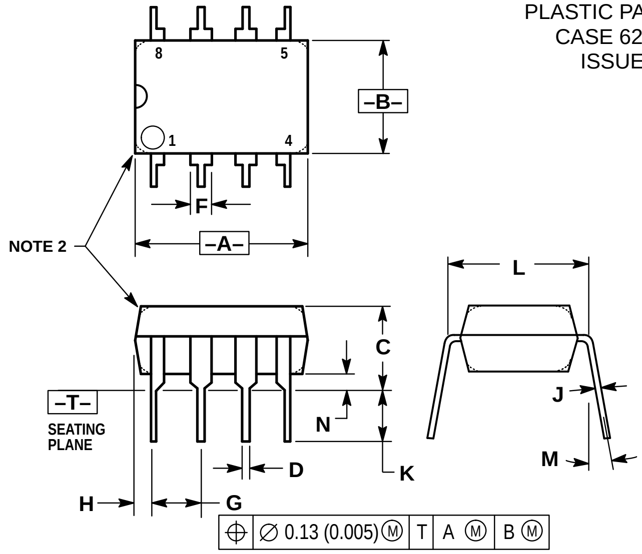


Figure 11. Differential Output Voltage



OUTLINE DIMENSIONS

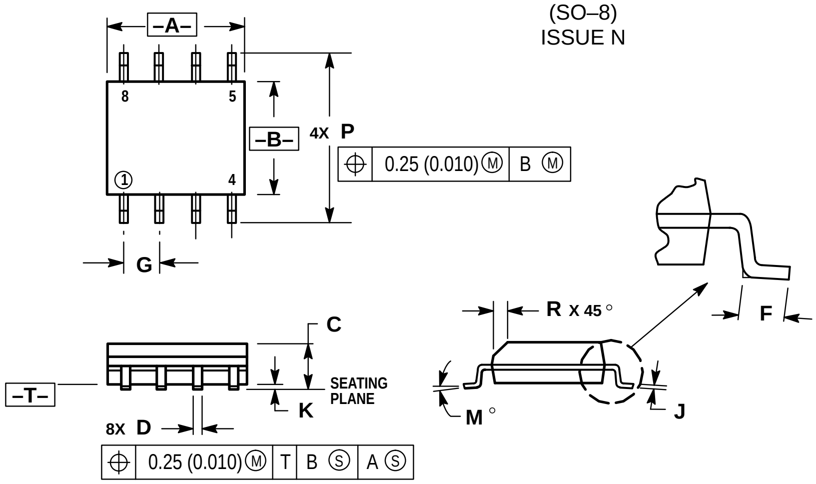
P SUFFIX
PLASTIC PACKAGE
CASE 626–05
ISSUE K



NOTES:
1. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
2. PACKAGE CONTOUR OPTIONAL (ROUND OR SQUARE CORNERS).
3. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	9.40	10.16	0.370	0.400
B	6.10	6.60	0.240	0.260
C	3.94	4.45	0.155	0.175
D	0.38	0.51	0.015	0.020
F	1.02	1.78	0.040	0.070
G	2.54 BSC		0.100 BSC	
H	0.76	1.27	0.030	0.050
J	0.20	0.30	0.008	0.012
K	2.92	3.43	0.115	0.135
L	7.62 BSC		0.300 BSC	
M	—	10°	—	10°
N	0.76	1.01	0.030	0.040

D SUFFIX
PLASTIC PACKAGE
CASE 751–05
(SO–8)
ISSUE N



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	4.80	5.00	0.189	0.196
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.18	0.25	0.007	0.009
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019

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